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Harari et al.



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[54] FLASH EEPROM SYST	EM
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[73] Assignee: SunDisk Corporation, Santa Clara,

Calif.

[21] Appl. No.: 963,838

[56]

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Related U.S. Application Data

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		371/10.3; 365/200
[52]	Field of Sourch	271 /100 101 100

371/10.2, 10.1, 10.3, 371/40.1; 365/200

References Cited

U.S. PATENT DOCUMENTS

4,601,031	7/1986	Walker et al 371/10.3
4,612,640	9/1986	Mehrotra et al
4,688,219	8/1987	Takemae
4,757,474	7/1988	Fukushi et al
4,757,474	7/1988	Fukushi et al

4,796,233	1/1989	Awaya et al	371/10.2
4,920,518	4/1990	Nakamura et al	371/10.2
4,949,309	8/1990	Rao	365/218

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[57] **ABSTRACT**

A system of Flash EEprom memory chips with controlling circuits serves as non-volatile memory such as that provided by magnetic disk drives. Improvements include selective multiple sector erase, in which any combinations of Flash sectors may be erased together. Selective sectors among the selected combination may also be de-selected during the erase operation. Another improvement is the ability to remap and replace defective cells with substitute cells. The remapping is performed automatically as soon as a defective cell is detected. When the number of defects in a Flash sector becomes large, the whole sector is remapped. Yet another improvement is the use of a write cache to reduce the number of writes to the Flash EEprom memory, thereby minimizing the stress to the device from undergoing too many write/erase cycling.

4 Claims, 5 Drawing Sheets

